NOAA Office of Ocean Exploration and Research
FY14 FFO Projects

Generic Cruise Plan Outline

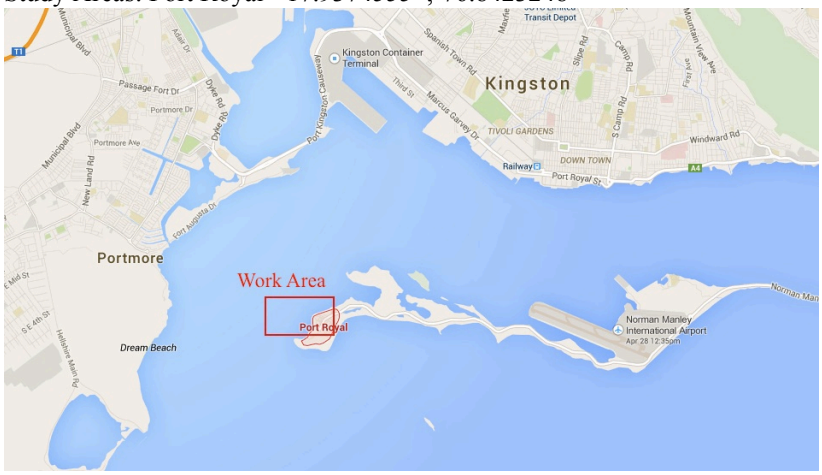
The Office of Ocean Exploration and Research (OER) does not require a specific format for cruise plans. All submitted cruise plans should address the following applicable elements:

1. **Cover page** - High Resolution Visual 3D Reconstructions for Rapid Archaeological Characterization, April 20th-28th 2015

2. **Table of contents**
3. **Cruise Overview:**
    a. Matthew Johnson-Roberson Matthew Johnson-Roberson, PhD
    Deep Robot Optical Perception Lab | http://droplab.engin.umich.edu/
    Assistant Professor, University of Michigan
    2600 Draper Drive, Ann Arbor, MI 48109-2145
    Email: mattjr@umich.edu Ph: +1 (734) 764-3767

    b. Land-based Cruise Port Royal Jamaica

    c. Study Areas: Port Royal - 17.9374555°,-76.8423248°



    d. Goals and Objectives
    The essential first stage of the project will be to gather sample data from across the site to calibrate our systems and allow the necessary adjustments to be made before returning in Year 2 for a two-week survey with the AUV and diver rig. This calibration survey will be conducted over one week. As the instrumentation on the diver rig is the essentially the same as the AUV (the biggest differences being the method of deployment and that the AUV can cover more area in the same time frame) it will be used to cover three survey boxes~10x15m over the full range of conditions offered by the site (initially we intend to target buildings, shipwreck elements and one of the outer forts most likely Fort James). Any problems encountered in gathering the data can then be worked on before the full survey trip in Year 2. This trip will also allow us to meet local collaborators and fixers, scope out possible working spaces for processing, maintenance and storage. We plan to use both a Sector-scan Sonar and a Multi-beam sonar to get broad area coverage of the site which will allow for dive planning in the second year.

4. **Description of operations:**
    a. We developed a visual mapping system using GoPro cameras to reduce cost and increase accessibility. This uses LED lighting and stereo synched action cameras. This involved mounting a set of cameras and lights on a diver propulsion vehicle (DPV).

OCEAN EXPLORATION & RESEARCH

We have also developed a modified autonomous surface vehicle (ASV) that has two sets of optical stereo-cameras and a multi-beam sonar. This vehicle will be used to identify areas of the site to map with the diver rig equipment. Another ship-based logging box has also been created to enable us to cover large areas of the site quickly using the multi-beam and a human controlled vessel.

b. Video recording: see above (all video will be gathered robotically).
c. Standard oceanographic: There are currently no plans to gathered such oceanographic data as this is tangential to the goals of the project.
d. Scientific sample processing: We will be gathering no samples as our permit is non-excavation
e. Small boat operations: As small boat is being obtained to enable site access and multi-beam mapping. This work is being done through the Jamaican National Heritage Trust and they are arrange small boat access.
f. Archaeological
    i. Currently no remote sensing will be employed but broad scale multi-beam will be used.
    ii. Site characterization: This is one of the primary goals of the project. We intend to have a strong handle on the archeological details of the site after this cruise. Additionally, we plan to understand the feasibility of optical mapping due to water clarity and visibility.
g. Visits - education and outreach events: We plan to put any 3D models generated into the open source free iOS app that will enable public outreach through the viewing of the models.
h. Other

5. Itinerary:

19/4/2015 -
Jon Arrive KIN 3:15pm BA2263 and Brian Arrive KIN 6:09PM DELTA 383 Andy Arriving AA1589 12:04PM Grand Port Royal Hotel Booking Under Johnson-Roberson Feel free to eat wherever if you'd like to go into town and just remember to save receipts for reimbursement
20/4/2015-
Depart DTW 1210PM DELTA 2005 -
DELTA 383 Arrive KIN 6:09PM Jie,Katie,Eduardo,Matt
Staying Grand Port Royal Hotel Booking Under Johnson-Roberson
Bring all equipment to hotel unpack and check for damage and do inventory.
We will make a plan as a group where to eat dinner.

21/4/2015-
AM: Breakfast at hotel and team meeting to setup equipment and divide up work areas. As team walk down to site with snorkel equipment and GoPro Diver Rig to do quick assessment as to swell and water clarity. Before lunch.
PM: After lunch at hotel. Eduardo can look at mounting multibeam on small boat and understand small boat working conditions (i.e. how many people can be onboard and power and cabling). Brian - work with Jon to understand Sector Scan areas of interest and logistics. Katie, Jie begin setup of ASV (given conditions) Andy sort dive kit.
Dinner and debrief for following day.
22/4/2015-
AM: Breakfast at hotel. Andy take ACFR diver rig to priority sites with high 3d relief and gather optical data. Brian take sector scan sonar to priority sites for archaeological purposes and gather maps. Katie, Jie, Eduardo attempt to run ASV on full site given conditions or if weather clarity not permitting do second full multibeam survey.
PM: Conditional on days results
23/4/2015-
AM: Breakfast meeting at hotel. Decide as a team priority areas and optimal vehicle allocation.
PM:Take preliminary results to show JNHT could be a swing afternoon if we don't have anything yet. Dinner in town if people are up for it.
24/4/2015-
AM:Breakfast at hotel: Focus on high res 3d maps for the day. Andy,Katie,Matt Take area of high relief and run ACFR diver rig and UM Diver Rig over same area multiple times to generate data set for direct comparison.
PM: Eduardo and Brian: Run multibeam on same site for comparison. Everyone else swing roles depending on who needs most help
25/4/2015-

Slack day- depending on how things are going either do what we failed to do in previous days or relax in the morning and work on processing existing data and documenting what works and doesn't work for following year.
Brian to DTW 8:55 AM DL 70 Jon's last full day

26/4/2015-
Jon to LHR at 17:50 BA2262
AM: UMich Team Run additional optical mapping with diver rigs and kingfisher
PM: Rest
27/4/2015-
AM:Explore and document land side of port royal for outreach and project documentation
PM: Pack up kit and get ASV shipped to U.S.

28/4/2015 - Jie to airport 12:35 PM Matt, Katie, Eduardo 8:55AM to DTW Andy takes off from site on own

6. **Personnel**
   a. List: Matthew Johnson-Roberson mattjr@umich.edu, Jon Henderson Jon.Henderson@nottingham.ac.uk, Eduardo Iscar eiscar@umich.edu, Katie Skinner kskin@umich.edu, Jie Li ljlijie@umich.edu, Brian Abbott bdabbott@outlook.com, Andrew Durrant andrewjohndurrant@gmail.com

   b. Berthing plan – We will be staying at the Grand Port Royal Hotel grandportroyal@gmail.com

7. **Organizational structure** – Matthew Johnson-Roberson, Cruise Leader
   Jon Henderson, Archeological Lead
   Selvenious Walters, JNHT Local Coordinator
8. **Equipment lists:**

Kingfisher Pelican	Pelican 1	Pelican 2	Pelican 3	Torpedo 1
250 lbs	47 lbs	60 lbs	60 lbs	47.6 lbs
				74.25 in.
Kingfisher vehicle	Sonar logging box	Yellow box		PACKED
Kingfisher user manual	keyboard	Go Pro Cases x2	Multibeam user manual	Torpedo 3
antenna x2	remote control	- go pro x2	joystick-wire	Torpedo 3
battery x2 (fully charged)	fluke meter	- dual case	joystick-wireless+charge cable	On/Off Ma
battery charger x2	flashlights x2	- battery charger	directional antenna	
directional antenna cables	multibeam			
wifi access point	power cord			
Torpedo battery charger x1				
Calibration board				

9. **Disposition of Data:**

The PI Dr. Johnson-Roberson, will handle the data management associated with the research aims of the project. He will take the lead and responsibility for coordinating and assuring data storage, access, and disseminating the results of the project. The PI utilizes cloud backup as well as several on-site backup methods to ensure no data loss occurs. The work discussed in the proposal will produce the following data: software, sensor data, 3D models, and scientific/archeological findings.

The software produced in this research study will be made publicly available through github, a free software hosting service. This will also serve as a backup for the code and as the projects versioning control system. This software will include real-time 3D reconstruction processing code, visualization tools, and the tablet app for public outreach. All software will be made open source to help build community support for the advancement of these technologies. The raw sensor data will be stored and backed up through the University of Michigans cloud hosting M+Box. The algorithm development will be documented through an electronic lab book that will be backed up offsite.

10. **Emergency information**

Kimberly Conklin
Contract and Grant Specialist
Naval Architecture and Marine Engineering
2600 Draper Drive - Room 222
Tel 734.763.9076
Fax 734.936.8820
Ann Arbor, MI 48109-2125

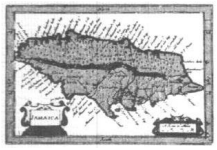
11. **Communications**

Marketing Communications Specialist
Nicole Panyard npanyard@umich.edu
Naval Architecture & Marine Engineering
222 NAME Bldg, 2600 Draper Dr.
Ann Arbor, MI 48109-2145
734/764-6470

12. **Miscellaneous:**
    a. HAZMAT inventory no hazardous materials being used.
    b. Meals: We will eat on site at Grand Port Royal Hotel

Appendices:

A. Detailed project descriptions
B. Primary operating area maps
C. Data Management Plan
D. MSDS sheets N/A
E. Permits and Certifications – Attached



JAMAICA NATIONAL HERITAGE TRUST
ARCHAEOLOGICAL RESEARCH PERMIT

This Agreement is made between the **Jamaica National Heritage Trust** a body corporate existing under and by virtue of section 3 of the **Jamaica National Heritage Trust Act** with offices at 79 Duke Street in the city and parish of Kingston (hereinafter called 'JNHT') of the FIRST PART and **Dr. Jon Henderson,** Department of Archaeology, University of Nottingham, University Park, Nottingham NG7 2RD UNITED KINGDOM and **Dr. Matthew Johnson Roberson**, Department of Naval Architecture and Marine Engineering, University of Michigan, 2600 Draper Drive, Ann Arbor, MI,USA 48109-2145 (hereinafter called singly, 'the 'Permittee' and collectively 'the Permittees') of the SECOND PART.

WHEREAS the JNHT has been empowered by virtue of section 4 of the **Jamaica National Heritage Trust Act**

(i) to conduct such research as it thinks necessary or desirable for the purposes of the performance of its functions;
(ii) to record any precious objects or works of art to be preserved; and
(iii) to make excavations on land for the purpose of investigating, inspecting or maintaining such land.

AND WHEREAS the JNHT is hereby of the view that the Permittees have met the criteria of the JNHT to conduct archaeological research in Jamaica; the Permittees being competent and accomplished professionals in Marine Archaeology, Image processing and Robotics Technology as evidenced by their training, education and experience, and a faculty members of noted educational institutions.

AND WHEREAS the Permittees have sought the permission of the JNHT to conduct an underwater survey at the submerged city in Port Royal in the parish of Kingston, specifically the territorial waters abutting the University of the West Indies Marine Lab, Old Naval Hospital and the line demarcating Morgan's Harbour for the period April 20, 2015 to April 21, 2017 (hereinafter called 'the Project Period') and further to conduct field research in the first instance for the period 20th – 27th April, 2015 (hereinafter called 'the First Field Work Period')

1. Project Objectives

(a) The objectives of the research are:

(i) To record the remains of the submerged site and assess state of preservation.
(ii) To utilise optical mapping technology to undertake a high resolution underwater survey of the remains of the submerged city in Port Royal to create an accurate and vastly high three dimensional resolution models of the remains.

(iii) To develop robust end-user tools and practices to create an open capture and processing platform for use by the archaeological profession to produce detailed, photorealistic plans and three dimensional models of submerged sites.

(b) The objectives will be achieved through the following activities:

(i) Calibration survey of the submerged site
(ii) Calibrate equipment and make adjustments where necessary
(iii) Conduct extensive AUV-based survey of the submerged city in Port Royal

(c) The activities for the First Field Work Period are as follows:

(i) Conduct calibration survey across the site with particular focus on buildings, shipwreck elements and Fort James
(ii) Calibrate equipment
(iii) Identify space for data processing, equipment maintenance and storage

2. The JNHT hereby grants to the Permittees permission to conduct the project for the period stated above, subject to the conditions hereinafter expressed.

3. The parties hereby agree as follows:

(1) The parties to this Agreement may, if necessary, make arrangements for the revision and/or extension of this Agreement on terms to be agreed in writing.

(2) That the requisite permission is granted by the owner or person/entity in control of the site to the Permittees to conduct the research authorised by this Permit, such permission to be in writing and provided to the JNHT.

(3) The Permittees shall engage only in the research identified herein, and any other research including excavation of the site is strictly prohibited and is a ground for termination of the Agreement.

(4) All research shall be done under the direct supervision of the JNHT's Technical Director of Archaeology or any other officer(s) of the Trust nominated by him.

(5) Members of the JNHT's Archaeology Division shall work with the project.

(6) The permit shall be duly signed by the parties and the fee of Five Hundred United States Dollars (US$500.00) paid before it shall take effect. It is further agreed by the parties that an additional charge for supervision and monitoring by the Technical Director of Archaeology at the rate of US $150 per work night and an Archaeology Field Assistant at US $60 per work night for each Project period is payable upon signing by the Permittees or at the beginning of each Project Period.

(7) All copyright in the research data shall vest in the Permittee for a period ending three years after the termination of this Agreement after which the Trust reserves the right to publish this material for the benefit of the Jamaican people.

(8) Save where the Permittee gives permission to another to use the information, all publication rights arising from the project shall vest in the Permittee, provided however, that proper credit is acknowledged to Jamaican contributors and the Trust, and further that:

(a) Three copies of all publications inclusive of any Thesis related to this research shall be made available to the Trust within two months of publication.

(b) The Permittee shall ensure that copies of all slides, photographs, inventories of objects, log books, diaries and other material generated by the project are deposited with the Trust within three months of the last day of each Research Period.

(c) The Permittee shall acknowledge and give credit to the Trust for all Trust research material used.

(9) Materials researched during the course of the project shall not be removed by the Permittee from the Trust's premises or from the jurisdiction of Jamaica without first obtaining the written authorization of the Trust and the owners of the material, and without providing the Trust with:

(i) A complete inventory of the artefacts and material to be so removed;
(ii) a statement outlining the purpose for such removal;
(ii) notification of the location to which the artefacts and material are being removed;
(iv) notification of the estimated time that the artefacts and material will be off the premises or out of the jurisdiction of Jamaica;

(10) The Permittees shall:

(a) Indemnify and keep the Trust indemnified against all losses, proceedings, liabilities, actions, and claims of public liability and/or personal liability, by itself or its servants and/or agents, and all other claims howsoever arising from the execution of the project.

(b) Ensure effective imparting of technical, technological and research skills to Trust personnel and to Jamaican students, and utilize as far as practicable, Jamaican personnel and students in the conduct of the project.

(c) Be responsible for his own arrangements and costs for conducting the project.

(d) Submit to the Trust a Report of the Project within three months of the last day of each Field Work Period.

(e) Ensure that the artefacts removed from the research area are properly conserved and stored within a time period and in a manner to be agreed between the Trust and the Permittees.

(f) Return to the Trust within twelve months of the last day of each Field Work Period all artefacts and material removed from the sites or from the jurisdiction of Jamaica pursuant to Clause 9, subject to any extensions in writing granted by the Trust.

(11) This permit shall be valid for a period of two (2) years from the date of signing, however each Field Work period within the validity of the permit period, except for the one specifically referred to in herein, must be authorised by the Trust in writing.

(12) The Trust reserves the right to terminate this Agreement:
(i) by giving at least three (3) days notice in writing if the Permittees fail to perform any of his obligations under this Agreement, or
(ii) With immediate effect without notice, for any criminal conduct engaged in by the Permittees or by any of her servants and/or personal representatives.

(13) If any dispute shall arise between the parties hereto in relation to any matter or thing herein contained, the same shall be referred in the first instance to mediation at the Dispute Resolution Foundation in Jamaica, and should the matter remain unresolved, then to Arbitration in accordance with the provisions of the Arbitration Act of Jamaica.

IN WITNESS WHEREOF the parties hereto have hereunto signed this Agreement on the

day of 2015.

Signed on behalf of
the **Jamaica National Heritage Trust**
by **VIVIAN CHIN, EXECUTIVE DIRECTOR** _____
this day of 2015

in the presence of: _____

Signed by the
said **JON HENDERSON** _____
this day of 2015

in the presence of: _____

Signed by the said
MATTHEW JOHNSON ROBERSON _____
this day of 2015

in the presence of: _____

JH & MJR…… JNHT
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